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(54) Process for Preparing Board Materials from Textile Wastes

(57) Coated or uncoated board materials comprising textile wastes or a mixture of textile wastes and lignocellulose material can be prepared with this invention. For this purpose, the textile wastes can be any structure and any type of raw material. This process enables the most extensive reuse of textile wastes. The examples describe the preparation of the textile wastes, mixing with binders and other additives and the molding technology. In addition, physical properties are cited. The most important are:

Gross density	620 – 680 kg/m^3
Flexural strength	0.8 – 1.2 N/mm^2
Tensile strength to the board plane	0.02 – 0.4 N/mm^2
Thermal conductivity	0.10 – 0.13 W/mK

This material is particularly suited for fabricating facing panels and insulating panels.

Field of Use of the Invention

The invention involves a process for preparing uncoated or coated board materials by using textile wastes or a mixture of textile wastes and lignocellulose material. These textile wastes can be any structure or any type of raw material A mixture of various textile fibers (for example, polypropylene, polyester) as well as a material comprising textile and non-textile components can be used (for example, floor covering). The boards prepared by the process are suited for insulation panels or isolation and packing material, the field of use not being limited by the cited examples.

Characteristics of Known Technical Solutions

Board materials, useful as insulating boards or reinforcing materials, are known to be prepared from shredded textile wastes (reclaimed fibers) and urea-formaldehyde resin or urea-formaldehyde-resin-adhesive (in powder form). The disadvantage of this process is the relatively high energy cost to shred the textile wastes, the lower inherent rigidity of the particles and the poor adhesion capability, The latter property of the reclaimed fibers is due to the strong tendency to felt.

To produce board materials from reclaimed fibers and having adequate strength requires a relatively high proportion of adhesive. On the other hand, increased adhesive makes the finished product brittle, increases board shrinkage and reduces shape stability.

Board materials are also known to be prepared from thermoplastic textile wastes by calendering (East German Patents 66 114, IPK Do 4j and 61 094, IPK B 29c). The different thermoplastic characteristics of the individual components of the material and the melting point of the plastic constituents being essentially in the range above 373° K create significant difficulties in this process. Due to the good thermal insulation behavior of the materials used, it is not possible, in particular with thick boards in the available time interval, to reach the required temperature in the center of the board to melt the particles. A certain increase in interfiber bonding is indeed achieved by spraying solvents on the particles, but the strength is seen as unsatisfactory as a whole.

German Utility Model 7440 735 discloses a pressed board in which other wastes and also textile wastes are bonded by a foamable binder, in particular a polyurethane foam binder. Due to the high price of the polyurethane components and the relatively low value-in-use of elements produced in this manner, the process is not presently economically feasible.

Subject of the Invention

The object of the invention is based on preparing a coated or uncoated board material having good thermal, physical-mechanical and other properties not achieved until now from textile wastes, mostly not recoverable until now, and with the lowest possible energy and material costs.

Description of the Nature of the Invention

The object of the invention is achieved by comminuting these wastes within certain limits, while maintaining their textile structure (for example, nonwoven, woven, knitted), to yield

planar particles, which have relatively high inherent rigidity compared to textile fibers, and bonding them by adding thermosetting and/or thermoplastic adhesives, in particular urea-formaldehyde resin. It was found surprisingly that bonding the textile wastes, forming the mat and applying pressure with heat can be conducted by a technique adapted largely from the production of particle boards. The physical-mechanical properties of the boards can be extensively influenced by modifying the density and binder proportion. It was also found that the physical-mechanical properties can be improved further by a proportional addition of particles of lignocellulose material such as wood chips and wood fibers.

Furthermore, in accordance with the object of the invention, these board materials were successfully coated with paper, film or textile sheet structures in one-way processes.

Examples

Example 1

Wastes from needle-punched felts, coated with synthetic rubber and comprising polypropylene fibers, polyester fibers and various fillers, are comminuted in a cutting mill. Particle measurements:

Length: 2 – 60 mm
Width: 2 – 40 mm
Thickness: 4 – 7 mm

100 parts by volume of these wastes are intermixed with 9 parts (solid resin) urea-formaldehyde resin in a bonding system current in the particle board industry. A mat having a density of 13 to 16 kg/m^2 is formed from the bonded particles and shaped into a board by pressure and heat.

The boards produced by the aforesaid process have the following properties at a thickness of ca. 22 cm:

Gross density: 620 – 680 kg/m^2
Flexural strength: 0.8 – 1.2 N/mm^2
Tensile strength perpendicular to board plane: 0.02 – 0.04 N/mm^2
Thickness swelling after 24 h in water: 6 – 10
Thermal conductivity: 0.10 – 0.13 W/mK

Example 2

Finishing wastes are comminuted by a guillotine cutter to flat particles. Particle measurements:

Length: 25 – 30 mm
Width: 11 – 15 mm
Thickness: 0.6 – 0.9 mm

100 parts by volume of these wastes are intermixed with 9 parts by volume (solid resin) of urea-formaldehyde resin in a bonding system current in the particle board industry. A mat having a density of 6 to 6.5 kg/m is formed from the bonded particles and shaped into a board by pressure and heat.

The boards produced by the aforesaid process have the following properties at a thickness of ca. 10 mm:

Gross density: 600 – 650 kg/m
Flexural strength: 1.2 – 2.4 N/mm
Tensile strength perpendicular to board plane: 0.01 – 0.03 N/mm
Thickness swelling after 2 h in water: 17 - 20

Example 3

Manufacturing wastes are comminuted by a guillotine cutter to flat particles having the dimensions listed in Example 2. 25 parts by volume of the manufacturing wastes are intermixed with 75 parts by volume of wood chips. 100 parts by volume of this particle mixture are intermixed with 9 parts by volume (solid resin) of urea-formaldehyde resin in a bonding system current in the particle board industry. A mat having a density of 6.1 to 6.7 kg/m is formed from the bonded particles and shaped into a board by pressure and heat. The boards produced by the aforesaid process have the following properties at a thickness of ca. 10 mm:

Gross density: 610 – 670 kg/m
Flexural strength: 9.0 – 10.0 N/mm
Tensile strength perpendicular to board plane: 0.28 – 0.33 N/mm

Claims

1. Process for preparing uncoated or coated board materials from textile wastes of any structure and any type of raw material (including mixtures of different textile fibers, for example, polypropylene and polyester, and of materials comprising textile and non-textile constituents, such as, for example, textile floor coverings) that are comminuted within certain limits or else are also usable directly, characterized in that the bonding of the textile wastes, the mat formation and the compression under the action of heat and/or pressure takes place according to a technology widely adapted for the production of particle boards, and in that these textile wastes can be intermixed with particles of lignocellulose material, such as, for example, wood chips or wood fibers, and these board materials can also be prepared coated in one-way processes with paper, film or flat textile structures.

2. Process according to Claim 1, characterized in that the textile wastes are comminuted to flat particles in a cutting mill using a sieve of 4 mm x 4 mm to 40 mm x 40 mm, but predominantly 30 mm x 30 mm.

3. Process according to Claim 1, characterized in that the bonding of the textile wastes, the mat formation and the compression under the action of heat and/or pressure takes place according to a technology widely adapted to the production of particle boards.

4. Process according to Claim 1, characterized in that particles of lignocellulose material, such as chips and fibers, can be intermixed with the textile wastes up to 90 (sic).

5. Process according to Claim 1, characterized in that this board material can be prepared also in a one-way process coated with paper, film or flat textile structures.

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